

Healthy Calves: Managing Physical Barriers to Infection

In a paper on applied immunology Dr. Don Sockett from the University of Wisconsin describes physical barriers that provide protection against infection. Here is his list:

- **Intact skin and mucous membranes**
- **Normal microbial flora**
- **Fatty acids in the skin**
- **Acid in the stomach (abomasum)**
- **Hair and cilia in the nasal and respiratory tract**
- **Enzymes in saliva, tears and intestine**
- **Coughing, sneezing, vomiting, urination, diarrhea**

He says, “The items listed above are designed to prevent the entrance of micro-organisms into the body or if they are introduced they can be rapidly destroyed (acids, enzymes) or eliminated from the body.”(NRAES 75, p42)

Promoting strong barriers: Intact skin and mucous membranes

What are the things we can do to promote strong physical barriers to infection? First, provide calving areas and calf housing that present few hazards for physical injury. That is, we want to keep the calf’s skin intact. Eliminating sharp pipes, broken gates and sharp ends on calf pens all help prevent scratching and cutting skin.

Remember, too, that we do not want to scratch the inside of mouths and throats. Especially, check your esophageal tube feeder. Are the ball and tube free of rough points that could cause injury? Try rubbing the ball against the skin on your face just below your eye – a very sensitive spot. If the ball feels rough it needs to be replaced.

Also, be certain that everyone using a tube feeder understands the need to lubricate the tube and to be gentle when inserting and removing it. I like to carry a tube feeder to the newborn calf with the tube immersed in the warm colostrum – that not only keeps the tube clean but also makes it very slippery for inserting it into the esophagus.

Promoting strong barriers: Normal microbial flora

The normal numbers of microbial flora in the gut will be reduced when we treat calves with antibiotics. Over a long enough time after we finish treatment this population will recover to its normal level.

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In the short run, however, we may wish to introduce a source of the most common normal microbial flora to speed up this recovery. There are a number of “probiotic” products on the market. Look for ones that contain lactic acid bacteria.

All of these products contain live cultures, which means the shelf life is very sensitive to storage temperature. Unless the product is refrigerated I recommend you purchase containers that will be used up within a month. That way even if the product is stored at room temperature (around 70°F) the chances of favorable bacteria survival are good. Remember heat is your enemy – store probiotics in a place that is 70 degrees or less.

Promoting strong barriers: Fatty acids in the skin

Essential fatty acids play a big part in skin health. Just as these fatty acids promote the health of cell membranes in the lungs and intestines they also influence skin cells ability to exclude things that can be harmful to a calf.

Young calves depending almost entirely on pasteurized milk or milk replacer usually have limited access to certain important fatty acids (C4, C18:3). **It is possible to supplement pasteurized milk and milk replacer with a fatty-acid specific product.** As calves become rumen competent and regularly consume significant amounts of calf starter or grower grains, supplementation probably will become less of an issue for calf health.

Promoting strong barriers: Acid in the stomach (abomasum)

Acidity or low pH in the abomasum is one barrier described by Dr. Sockett. How do you imagine we influence the acid level (pH) in the abomasum? Every time we feed milk or milk replacer to a calf the pH in her abomasum goes up. The acid level goes back to normal within a few hours. This is good because acidic conditions are hostile to pathogenic bacteria.

Research using up to five feedings daily did show a decrease in the cumulative time the abomasum had undesirable pH levels. The difference between many feedings and twice daily feedings was judged not to be an issue for calf health.

However, intensive milk feeding programs with twice daily feeding may provide a very large volume of milk at 1 time. This can extend the time for high pH conditions. Thus, it is important to have high immunity levels from good colostrum management as well as a strict sanitation program to reduce pathogen exposure.

One-time-a-day feeding programs for calves usually provide 1.3 to 1.5 pounds of dry matter in 1 feeding (5 to 6 quarts of high concentration milk replacer or whole milk supplemented with powder). Both options can extend the time for high pH conditions. Thus, it is important to have high immunity levels from good colostrum management, as well as a strict sanitation program to reduce pathogen exposure.

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Extended use of electrolytes containing bicarbonates increases the time that the abomasum is at an unfavorable pH level as well. Treatment of diarrhea with oral electrolytes should be discussed with your veterinarian.

Promoting strong barriers: Hair and cilia in the nasal and respiratory tract

We cannot see cilia in a calf's windpipe (trachea). Even though they are small they have a big job. When working properly they do a good job reducing the number of pathogens that get down into the respiratory tract. Normally, each cilium waves back and forth to push foreign objects up and out. In addition, there is "wave-like" movement that further ejects pathogens. As ammonia gas levels increase in a calf's environment these protective mechanisms do not work well. Usually this is less of a problem with calves raised in hutches compared to those raised in barns.

We can attack ammonia gas problems 2 ways. One is to slow down the production of gas. Clean bedding reduces the mixing of urine and feces that promotes gas production. Even if they do mix, when urine and feces are in dry bedding (less than 35% moisture) ammonia gas is reduced. Keeping enough bedding in pens so that you do not get wet knees when kneeling is a practical way to assess adequate dryness.

The other way to attack ammonia gas problems is to provide good air exchange in the barn. In northern climates this most often is an issue during the coldest winter months. The temptation in cold weather is to close up barns. Elevated ammonia gas levels often result.

To read "Ventilation Air Exchange Rates" developed by Curt Gooch, Cornell Pro-Dairy for recommended volumes for selected size animals for different seasons go to www.calffacts.com and scroll down to Ventilation Air Exchange Rates. Managing ventilation in calf barns resource is at www.calffacts.com, scroll down to Ventilation for Calf Barns.

Promoting strong barriers: Enzymes in saliva, tears and intestine

All saliva, tears and intestinal secretions are water dependent. Thus, providing free choice water to calves to promote optimum hydration is another way to promote strong barriers.

For young calves I have found that water consumption is better when the water temperature matches the calf body temperature (that is, around 102F or 39C).

For calf operations that start calves with a bottle and then switch to pail feeding, I have found that during the first week offering warm water in a bottle for a few days will promote adequate water consumption. This may be needed in high stress situations such as bad weather or milk replacer feeding programs with dry matter concentrations over 17 %.

Promoting strong barriers: Coughing, sneezing, vomiting, urination, diarrhea

All of these actions provide a way for a calf to get rid of anything that can cause infection. In that sense they are all good actions.

At the same time we are challenged to help the calf keep feeling well enough to eat and rest. Every calf enterprise needs to have veterinarian-approved procedures for treating respiratory illnesses (coughing, nasal discharge) and intestinal disorders (diarrhea).

Reference” NRAES “Dairy Calves and Heifers: Integrating Biology and Management” conference proceedings, January 25-27, 2005. NRAES-175.